Class XII Session 2024-25
Subject - Biology
Sample Question Paper - 7

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. Ecosystem creates: **[1]**

   a) Food chains b) Both of these

   c) Food web d) Ecological pyramid

2. The specialized procedure to form an embryo in a laboratory in which a sperm is directly injected into the ovum is called: **[1]**

   a) Zygote intra fallopian transfer b) Intracytoplasmic sperm injection

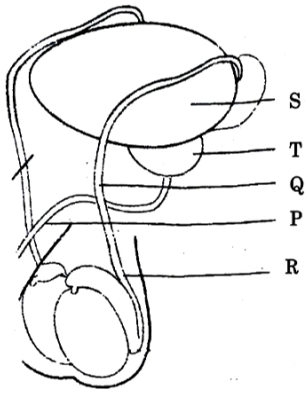
   c) Intra- uterine insemination d) Gamete intrafallopian transfer

3. Which one among the following regions is not a hotspot of biodiversity? **[1]**

   a) The Indo-Burma Region b) The Western Ghats and Sri Lanka

   c) The Himalayas d) Jaintia Hills in Meghalaya

4. A human male decides to adopt a surgical method for contraception. Identify the point in the diagram where a cut would be made and tied. **[1]**



a) Point P

b) Point S

c) Point Q

d) Point R

5. Which of the following samples of DNA in the table given below will give the desired result during polymerase chain reaction? **[1]**

a)

Sample	Temperature used for Denaturation	Enzyme used for extension
II	Low temp./50^{o}C	Heat stable

b)

Sample	Temperature used for Denaturation	Enzyme used for extension
I	High temp./90^{o}C	Heat stable

c)

Sample	Temperature used for Denaturation	Enzyme used for extension
III	Low temp./50^{o}C	Heat resistant

d)

Sample	Temperature used for Denaturation	Enzyme used for extension
IV	High temp./90^{o}C	Heat unstable

6. Which of the following organisms not fix atmospheric nitrogen? **[1]**

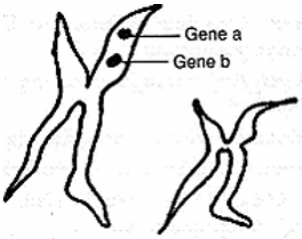
a) Oscillatoria

b) Nostoc

c) Spirogyra

d) Anabaena

7. Given below is a highly simplified representation of human sex chromosomes from a karyotype. The genes a and b could be of: **[1]**



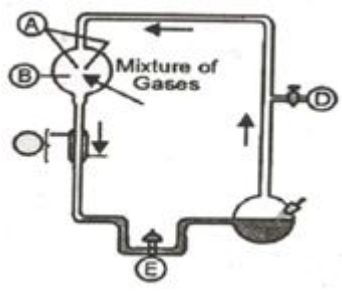
a) Colour blindness and body height

b) Attached ear lobe and Rh blood group

c) Phenylketonuria and haemophilia.

d) Haemophilia and red green colour blindness

8. What was the resultant found in the place marked E? **[1]**



a) Glucose, fatty acids and lipids

b) Some fatty acids and organic acids

c) Some amino acids as glycine and alanine

d) Organic esters only

9. Among the following, where do you think the process of decomposition would be the fastest? **[1]**

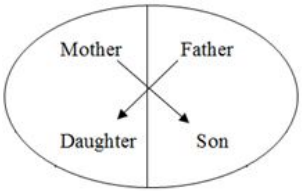
a) Alpine region

b) Antarctic

c) Dry arid region

d) Tropical rain forest

10. Represented below is the inheritance pattern of a certain type of trait in humans. Which one of the following conditions could be an example of this pattern? **[1]**



a) Thalassemia
b) Haemophilia
c) Sickle Cell anemia
d) Phenyl ketonuria

11. Which of the following seeds have remained alive for the longest period? **[1]**

a) Yucca gigantea
b) Mangifera indica
c) Striga asiatica
d) Phoenix dactylifera

12. The most important feature in a plasmid to serve as a vector in gene cloning experiment is: **[1]**

a) Its size
b) Presence of a selectable marker
c) Origin of replication (ori)
d) Presence of sites for restriction endonuclease

13. **Assertion (A):** Zero population growth should be achieved as early as possible to control the human population. **[1]**
Reason (R): This requires not two children per couple but a little more.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

14. **Assertion:** Penicillin was the first antibiotic to be discovered, and it was a chance discovery. **[1]**
Reason: Alexander Fleming discovered Penicillin while working on Staphylococci bacteria.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
c) Assertion is correct statement but reason is wrong statement.
d) Assertion is wrong statement but reason is correct statement.

15. **Assertion (A):** Decomposition process is slower if detritus is rich in lignin and cutin. **[1]**
Reason (R): Decomposition is largely an oxygen requiring process.

a) Both (A) and (R) are true and (R) is the correct explanation of (A).
b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
c) (A) is true, but (R) is false.
d) (A) is false, but (R) is true.

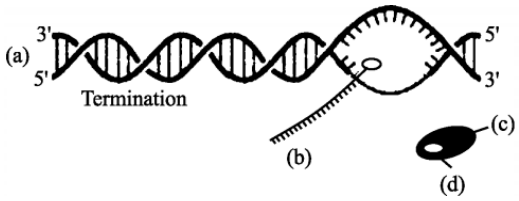
16. **Assertion (A):** Homologous organs have common ancestry and similar functions. **[1]**
Reason (R): Analogous organs have unlike origin and dissimilar function.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) Both A and R are false.

Section B

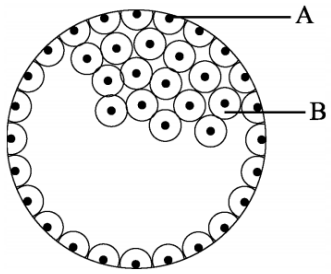
17. What are flocs? State their role in biological treatment of sewage. **[2]**

18. The process of termination during transcription in a prokaryotic cell is being represented here. Name the label a, b, c and d. **[2]**



19. Differentiate between perisperm and endosperm giving one example of each. **[2]**

20. In the given figure, give the name and functions of parts labelled A and B. **[2]**



21. a. Give an example of viral biocontrol agent. **[2]**

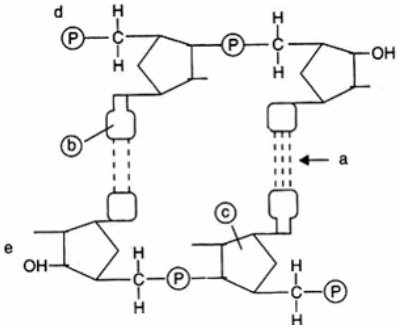
b. Why are they considered to be desirable when an ecologically sensitive area is being treated?

OR

Mention the common bacterium found in the anaerobic sludge during sewage treatment and also in the rumen of cattle. How is this bacterium commercially useful?

Section C

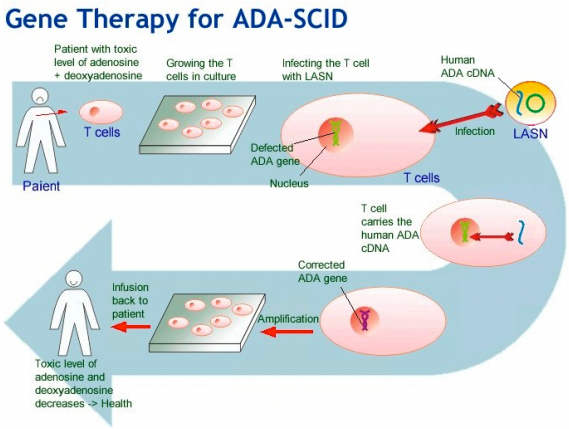
22. Study the given portion of double-stranded polynucleotide chain carefully. Identify a, b, c and the 5' end of the chain. **[3]**



23. Generally, it is observed that human males suffer from hemophilia more than human females, who rarely suffer from it. Explain giving reasons. **[3]**

24. Explain the difference between commensalism and mutualism types of interactions, with the help of a suitable example of each. **[3]**

25. This image highlights the process of Gene Therapy of ADA-SCID. **[3]**



i. Mention the cause of ADA deficiency in humans.

ii. How has genetic engineering helped patients suffering from it?

26. Explain the concept of **co-extinction** by taking two examples. **[3]**

OR

Bio-diversification of life started to occur almost 3 billion years ago. Since then new species have been evolving and then disappearing en masse from earth.

a. How many episodes of mass extinctions of species have already taken place and which one is in progress in the current era?

b. How is current episode in progress different from the previous episodes and why? Explain.

27. While creation and presence of variation are directionless, natural selection is directional as it is in the context of adaptation. Comment. **[3]**

28. Answer the following questions with reference to **opioids**, the commonly abused drug : **[3]**

a. Where in our body are the specific opioid receptors present?

b. What is heroin chemically known as?

c. Write the scientific name of the plant from which opioids are extracted.

Section D

29. **Read the following text carefully and answer the questions that follow:** **[4]**

Cleavage is the series of rapid mitotic divisions in zygote and forms blastula. The 2, 4, 8, 16 daughter cells are called blastomeres. Embryo with 64 blastomeres is known as blastocyst and has blastocoel cavity. Blastocyst gets implanted in uterine wall and leads to pregnancy.

i. Why the cells of the inner cell mass of blastocyst are called stem cells? (1)

ii. At which stage of embryonic development trophoectoderm develops? (1)

iii. What is the site of implantation? (2)

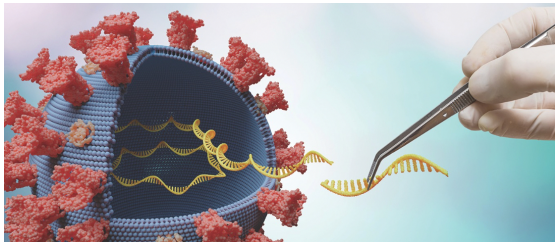
OR

What is the correct sequence of various structures formed during embryonic development? (2)

30. **Read the following text carefully and answer the questions that follow:** **[4]**

A pathogen is defined as **an organism causing disease to its host**, with the severity of the disease symptoms referred to as virulence. Pathogens are taxonomically widely diverse and comprise viruses and bacteria as well as unicellular and multicellular eukaryotes. The immune system of a person is suppressed. He was found

positive for a pathogen in the diagnostic test ELISA.



i. Name the disease, the patient is suffering from. (1)

ii. Which pathogen is identified by ELISA test? (1)

iii. Which cells of the body are attacked by the pathogen? (2)

OR

Suggest preventive measures of the infection. (2)

Section E

31. What are the advantages and disadvantages of cross-pollination? **[5]**

OR

i. How are the characteristic features of pollen, anther and stigma of a maize plant suited for pollination by wind?

ii. How do you justify that:

1. Pollen grains are recovered from fossils?
2. Micropyle remains as a small pore in the seed coat of a fully developed seed?

32. a. Describe aminoacylation of tRNA. **[5]**

b. Explain the process that takes place in the ribosomes when mRNA makes its entry into it in a prokaryote.

c. Due to transcription error, ATG codon of DNA is transcribed into UAG in mRNA which translates a non-functional polypeptide chain in the ribosome. Justify the statement.

OR

Explain the two complexities that are observed in the process of transcription in eukaryotes and not in prokaryotes.

33. Bioreactors are the containment vehicles of any biotechnology-based production process. For large scale production and for economic reasons the final success of biotechnological process depends on the efficiency of the bioreactor. **[5]**

Answer the following questions w.r.t. the given paragraph:

i. List the operational guidelines that must be adhered to so as to achieve optimisation of the bioreactor system. Enlist any four.

ii. Mention the phase of the growth we refer to in the statement **Optimisation of growth and metabolic activity of the cells.**

iii. Is the biological product formed in the bioreactor suitable for the intended use immediate? Give reason in support of your answer.

OR

Write any four ways used to introduce a desired DNA segment into a bacterial cell in recombinant technology experiments.

Solution

Section A

1.

(b) Both of these
Explanation: Both of these

2.

(b) Intracytoplasmic sperm injection
Explanation: Intracytoplasmic sperm injection is a specialized procedure to form an embryo in a laboratory in which a sperm is directly injected into ovum for fertilization to form a zygote.

3.

(d) Jaintia Hills in Meghalaya
Explanation: The hotspot area includes all the seven districts, i.e. East Garo Hills, West Garo Hills, South Garo Hills, East Khasi Hills, West Khasi Hills, Jaintia Hills and Ri-Bhoi

4.

(c) Point Q
Explanation: Point Q

5.

(b)

Sample	Temperature used for Denaturation	Enzyme used for extension
I	High temp./90^{o}C	Heat stable

Explanation:

Sample	Temperature used for Denaturation	Enzyme used for extension
I	High temp./90^{o}C	Heat stable

6.

(c) Spirogyra
Explanation: Spirogyra is a filamentous alga. This alga does not fix atmospheric nitrogen. Anabaena, Nostoc, and Oscillatoria can heterocyst that can fix atmospheric nitrogen.

7.

(d) Haemophilia and red green colour blindness
Explanation: Haemophilia and red-green colour blindness both are a sex-linked recessive gene on X chromosome. Body height is an example of polygenic inheritance. Rhesus blood group is base on the presence or absence of Rh-protein on the surface of RBC, phenylketonuria (PKU) is a recessive autosomal variation.

8.

(c) Some amino acids as glycine and alanine
Explanation: In Urey and Miller’s experiment, the product formed after the continuous sparking in the mixture of gases at high temperature were some amino acids like glycine and alanine. Sugar and nitrogenous base were also obtained from the same set up by some other scientist.

9.

(d) Tropical rain forest
Explanation: Dead plant remains such as leaves, bark, flowers, and dead remains of animals, including fecal matter, constitute detritus, which is the raw material for decomposition. The tropical rain forest produces the highest biomass and hence produces the highest detritus. Hence the rate of decomposition is highest in the tropical rain forest.

10.

(b) Haemophilia

Explanation: The inheritance pattern of a certain type of trait in humans shown above is haemophilia.

A son cannot inherit the defective gene from his father. This is a recessive trait and can be passed on if cases are more severe with the carrier. Genetic testing and genetic counselling are recommended for families with haemophilia. The disease is X-linked and the father cannot pass haemophilia through the Y-chromosome.

11.

(d) Phoenix dactylifera

Explanation: Phoenix dactylifera remained alive for longer period

12.

(c) Origin of replication (ori)

Explanation: Origin of replication (ori) is a sequence from where replication starts and any piece of DNA, when linked to this sequence, can be made to replicate within the host cells. This sequence is also responsible for controlling the copy number of the linked DNA.

13. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: Two children per couple holds good for zero population growth. But in large democratic countries like India, it will take a little more.

14. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation: Assertion and reason both are correct statements and reason is correct explanation for assertion.

15.

(b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

Explanation: Both (A) and (R) are true, but (R) is not the correct explanation of (A).

16.

(d) Both A and R are false.

Explanation: Homologous organs are those which have the same essential structure, which they inherit from common ancestors though they may be very differently modified in adaptation to different functions.

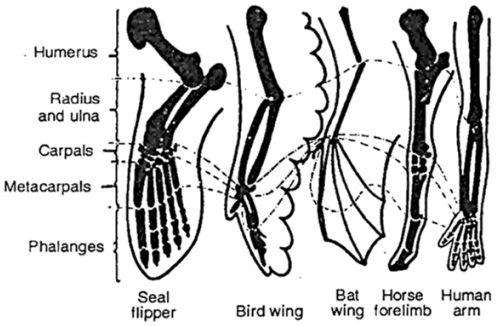


Fig. Homology in the forelimbs of seal, bird, bat, horse and man (apparently different but constructed on the same basic pattern).

For example - in case of whales hind limbs are only represented internally and are not apparent externally, the forelimbs modified into paddles and retain the bones of the shoulder, forearm, wrist and fingers all of which are enclosed in a finshaped sac; the head is fish-like but possesses all the mammalian bones. Analogous organs are those which have similar structure connected with similarity of function have superficial resemblance to one another, but are of unlike origin. For example, the wings of a bat and wings of a bird doing the same flying function possess superficial resemblances to each other.

Section B

17. Flocs are masses of bacteria held together by slime and fungal filaments to form mesh like structures. They are formed during the secondary treatment of sewage.

Consume major part of organic matter in the effluent/lower BOD significantly/reduces polluting potential.

18. a. DNA molecule
    b. mRNA transcript
    c. RNA polymers
    d. Rho factor

19. Perisperm is the remnant of nucellus persistent in the mature seeds of some plants e.g., black pepper, beet etc.

The endosperm is a nutritive tissue (triploid) present in the albuminous seeds e.g., coconut, cereals, castor etc.

20. A. = Trophoblast - Gets attached to the endometrium and draws nutritive material secreted by uterine endometrium gland.
    B. = Inner cell mass - Differentiates as Embryo.
21. a. Baculoviruses / Nucleopolyhedrovirus
    b. They are considered to be good bio-control agents because these viruses are excellent candidates for species-specific, narrow-spectrum insecticidal applications and show no negative impacts on plants, mammals, birds or even non-target insects and are desirable for integrated pest management.

OR

The group of bacteria found in both the rumen of cattle and sludge of sewage treatment is Methanogen bacteria. Biological methanation occurs naturally in swamps, digestive systems of animals, oil fields and other environments and is already commonly used in sewage water plants and biogas plants.

Section C

22. a. Hydrogen bonds
    b. Purine base
    c. Pentose sugar (Deoxyribose)
    d. 5' end of the chain - d
23. Haemophilia is a recessive X-linked genetic type disorder. Haemophilia is more common among males than females because males only inherit one X-chromosome. There are 46 chromosomes in humans Females have XX chromosome while males have X and Y chromosome. So, male offspring inherit X-chromosome from their mother and Y-chromosome from them father Males only have one X-chromosome and if the X-chromosome and this is the reason that males are suffering from haemophilia is the x-chromosome carries the mutation. While in females as they have so X chromosomes, and this is a recessive disorder.
24. **Commensalism:** This is the interaction in which one species benefits and the other is neither harmed nor benefitted. An orchid growing as an epiphyte on a mango branch, and barnacles growing on the back of a whale benefit while neither the mango tree nor the whale derives any apparent benefit.
    Mutualism: This interaction confers benefits on both the interacting species. Lichens represent an intimate mutualistic relationship between a fungus and photosynthesising algae or cyanobacteria. Similarly, the mycorrhizae are associations between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates.
25. i. Deletion of the gene for ADA in an individual leads to ADA deficiency disorder Adenosine Deaminase (ADA) enzyme is crucial for immune system to function.
    ii. Gene therapy is helpful in the treatment of ADA deficiency.
    The treatment involves the following steps:
    a. Lymphocytes from the blood of patient are grown on a culture outside the body.
    b. A functional ADA, cDNA (using a retroviral vector) is then introduced into these lymphocytes.
    c. Such genetically engineered lymphocytes are returned to the blood of patient.
    d. Periodic infusion of such genetically engineered lymphocytes is required by the patient.
26. When a species becomes extinct, the plant and animal species associated with it in an obligatory way also becomes extinct. Examples:
    - When a host (fish) species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct.
    - Coevolved plant-pollinator mutualism where extinction of one leads to the extinction of other (any other example) / The coevolved orchid Ophrys and bee pollinator.

OR

a.
- Five extinctions have already occurred
- Sixth is in progress

b.
- Sixth extinction is much faster / sixth extinction is 100 to 1000 times faster
- Human activities like industrialisation, loss of habitat, over exploitation, land reforms.

27. Variations keep on occurring in each subsequent generation. But most of them may not be retained by the organism because nature may not support such variations. When a particular variation passes the test of natural selection, then only it is inherited in a species in the long run. Hence, it can be said that creation and presence of variation is directionless but natural selection and adaptation are directional.
28. a. Opioid receptors are present in various regions of the body, including the central nervous system (brain and spinal cord) and peripheral nervous system.

b. Heroin is chemically known as diacetylmorphine.

c. Opioids are extracted from the opium poppy plant, scientific name of the plant is Papaver somniferum.

Section D

29. i. The embryo at 64 celled stage is known as blastocyst. It comprises of an inner cell mass which is attached to embryonic pole and an outer covering of cells which is known as trophoblast. The trophoblast later forms the chorion which is part of placenta. The inner cell mass has the property to undergo unlimited symmetrical divisions without getting differentiated.

ii. Embryo with 64 cells is called blastula (blastocyst) and has blastocyst cavity. Blastocyst is composed of an outer envelope of cells called trophoblast and inner cell mass.

iii. Implantation is the attachment of blastocyst to the uterine wall. The portion of blastocyst where the inner cell mass is located lies against the endometrium of uterus.

OR

Zygote $\rightarrow$Morula $\rightarrow$Blastula $\rightarrow$Gastrula.

30. i. The patient is suffering from AIDS (Acquired Immuno Deficiency Syndrome).

ii. HIV (Human Immunodeficiency Virus) identified by the ELISA.

iii. Helper T-cells, macrophages, B-lymphocytes are attacked by the pathogen.

OR

Preventive measures:

a. People should be educated about AIDS transmission.

b. Disposable needles and syringes should be used.

c. Sexual habits should be changed immediately.

d. High-risk groups should be discouraged from donating blood.

e. Routine screening may be done.

Section E

31. Advantages of cross-pollination :

i. Cross-pollination brings about genetic recombinations and introduces the variations in the offsprings. Some of these variations are more useful and help the individuals in the struggle for existence and adapt to the changing environment.

ii. Plants are diseases resistant.

iii. New and improved varieties of plants can be produced by artificial cross-pollination.

iv. The yield is quite high and never falls below an average minimum.

v. The seeds are much better, usually larger, healthy and more vigorous due to the phenomenon of hybrid vigour.

Disadvantages of cross-pollination :

i. Cross-pollination is not a sure method as the chance factor is always there.

ii. It is a less economical and highly wasteful method as plants have to spend a large amount of energy to produce a large number of pollen grains, develop many devices to promote and effect this kind of pollination by various pollinating agencies.

iii. Harmful or undesirable characters may be introduced in the individuals and may persist in the race permanently.

iv. The very good characters of the race are likely to be lost in the next generation.

OR

i. The characteristic features of pollen, anther, and stigma in maize plants are adapted for wind pollination:

- Pollen- light / non-sticky, to travel easily through air
  produce in enormous amount, to compensate the wastage during pollination
- Anther -well exposed, pollen easily dispersed into wind current
- Stigma -Large / often feathery, to easily trap air-borne pollen grains

ii. 1. Pollen grains have hard outer layer exine made up of sporopollenin, which is one of the most resistant organic material known / no enzyme can degrade sporopollenin.

2. It allows the entry of water, oxygen into the seed at the time of germination.

32. a. In the first phase itself, amino acids are activated in the presence of ATP and linked to their cognate tRNA–a process commonly called as charging of tRNA or aminoacylation of tRNA to be more specific. If two such charged tRNAs are brought close enough, the formation of a peptide bond between them would be favored energetically.

b. Small subunit of ribosome binds to mRNA at start codon (AUG) at 5’ end, in the two sites of large subunits of ribosome, the charged tRNA with the aminoacid corresponding to the codon on mRNA align, formation of peptide bond between the two closely placed amino acids in the two sites occur, with the help of ribozyme in the ribosome, peptide chain elongation continues till the stop codon (UAG, UGA, UAA) on the mRNA reach the big unit of ribosome.

c. Due to transcription error, ATG codon of DNA is transcribed into UAG in mRNA which translates a non-functional polypeptide chain in the ribosome. This means that due to transcription error i.e presence of G in place of C there will be a synthesis of incorrect protein. Since the codon, UAG stops codon and it will cause termination of the polypeptide chain synthesis.

OR

Two complexities that are observed in the process of transcription in eukaryotes and not in Prokaryotes are as follows

i. There are three RNA polymerases in the nucleus RNA polymerase I transcribes - rRNAs, RNA polymerase II transcribes - heterogenous nuclear RNA/hnRNA, RNA polymerase III transcribes - tRNA / 5 srRNA / snRNA (small nuclear RNAs).

ii. Primary transcripts / hnRNA contain both the exons and non functional introns, subjected to splicing where introns are removed, exons are joined in a defined order, hnRNA undergoes processing called capping and tailing, In capping nucleotide methyl guanosine triphosphate is added to 5' end of hnRNA, In tailing adenylate residues (200-300) are added at 3'- end in a template independent manner, this fully processed hnRNA is now called mRNA (and transported out of the nucleus for translation).

33. i. Optimisation of the bioreactor system can be achieve by Temperature, pH, Substrate, Salts, Vitamins, Oxygen

ii. Log phase/Exponential phase is referred

iii. No

It needs separation and purification/down-streaming process/quality control testing/needs to be formulated with suitable preservatives/clinical trials.

OR

Four-ways of introducing the desired DNA segment into a bacterial cell are as follows:

i. **Competent host (For transformation with recombinant DNA):**

a. For transformation, bacterial cells are treated with a specific concentration of calcium which increases the efficiency with which DNA enters the bacterium through pores in its cell wall.

b. Cells with recombinant DNA are incubated on ice, followed by placing them briefly at 42°C (heat shock) and then putting them back into ice.
This enables the bacteria to take up recombinant DNA.

ii. **Micro-injection:** Recombinant DNA is directly injected into the nucleus of an animal cell.

iii. **Biolistic or Gene gun:** Plant cells are bombarded with high-velocity micro-particles of gold or tungsten coated with DNA.

iv. **"Disarmed pathogen" vectors:** (Ti- plasmid); retroviruses which when allowed to infect the cell, transfer the recombinant DNA into the host.